TRINITY AND BEYOND

Ambassador Linton F. Brooks

Administrator, National Nuclear Security Administration and
Under Secretary of Energy for National Security
Presented to the National Academy of Sciences Symposium
"60th Anniversary of Trinity: First Manmade Nuclear Explosion, July 16, 1945"
14 July 2005

"Suddenly, there was an enormous flash of light, the brightest light I have ever seen or that anyone has ever seen." -- Isador Rabi

"The thing that got me was not the flash but the blinding heat of a bright day on our face in the cold desert morning. It was like opening a hot oven with the sun coming out like sunrise." -- Phillip Morrison

Two scientists describing a brief moment in the New Mexican desert on the morning of 16 July 1945, a moment that transformed all of our lives. When the bomb went off that morning, a blind woman being driven Albuquerque is reported to have asked, "What was that?" What indeed!

Thank you for inviting me to participate in this important meeting to commemorate that awe-inspiring event of 60 years ago, to honor those among us who participated in the effort to develop and test that first nuclear device, and to recall where we have been and where we are going with regard to our nuclear weapons and forces. The past has made us who we are today, both as individuals and as a nation. We need to understand the past so it can help point the way to the future. That's why what is being done here today to capture and remember the events, the history, the people and the activity associated with Trinity is so valuable.

This workshop asks us to look in two directions. We look backward to that remarkable day 60 years ago this Saturday when human history changed forever. And we look forward to try to understand what we as a nation will do with the combined gift and curse that is the legacy of that unique morning. My role, as your program clearly indicates, is to

look forward. But before I do, I want to take a moment to look back. First, of course, because like all of us here, I want to pay my respects to the extraordinary individuals who are with us on this 60th anniversary of the birthday of the Atomic Age. Within three and a half years of the first controlled release of nuclear energy, the scientists and engineers from the Manhattan Project provided us with the means—the atomic bomb—to rapidly end the most devastating war of our time.

Think of these remarkable individuals:

- **Harold Agnew, who witnessed the first controlled nuclear chain reaction and also flew on the Hiroshima mission as a scientific observer.**
- **Hugh Bradner, who helped plan the new laboratory at Los Alamos.**
- **Robert Christy, who helped design the core of the plutonium bomb.**

- **Val Fitch, who participated in the technical work at Trinity and later won the Nobel Prize in physics.**
- **Don Hornig, who designed the firing set for "Fat Man" and who was the last man to leave the top of the tower that fateful New Mexico morning.**
- **Lawrence Johnston, who helped achieve uniform implosion in the plutonium bomb by inventing the exploding bridgewire detonator, and who later flew over Hiroshima and Nagasaki as a scientific observer.**
- **Arnold Kramish, who was responsible for detonator simultaneity in the plutonium bomb.**
- **Pief Panofsky, who helped design instruments to measure explosive yields from Trinity, Hiroshima and Nagasaki.**
- **Louis Rosen, who worked to solve the neutron pre-initiation problem and developed nuclear test diagnostics.**

- **Maurice Shapiro, who was a group leader at Los Alamos and worked on weapons hydrodynamics..**
- **Rubby Sherr, who made important contributions to developing the initiator for the plutonium bomb.**

Perhaps the best tribute to these remarkable individuals is a recent Senate resolution authored by New Mexico Senator Pete Domenici. It refers to Trinity as "one of the seminal events in human history" and "acknowledges the brilliance and dedication of the men and women" who brought it about.

Senator Domenici's resolution shows why it is important for us as a nation to remember this anniversary. But I also want to look back, because, like many in my generation and, perhaps, many in this room, I owe these individuals and their many colleagues a very personal debt. It is quite possible that I am alive only because of their accomplishments. I was commissioned in the Navy in 1959 and spent much of the next 30 years anticipating a war with the Soviet Union. My

professional life was defined in 1946, in a small Midwestern city named Fulton, Missouri, when Winston Churchill said that, "From Stettin in the Baltic to Trieste in the Adriatic, an iron curtain has descended across the continent." His speech marked the beginning of America's longest war—a Cold War with no defined start or end, no front lines, no declaration of war, and no victory parades. It was a war that was won, in part, by our honorees today who participated in the Manhattan Project and helped create the success at Trinity site. I was at one time something of an expert on the Soviet Navy and it is my clear professional judgment that had that Cold War become a shooting war, many of my friends--and perhaps I--would not have survived.

But the hot war didn't come. Why not? Why, when the West was faced with an expansionist power with a messianic ideology did global war never break out? Why did the wars in Korea and Vietnam and Africa and Afghanistan never lead to global war? The truth is, we don't know. The nature of

deterrence is that you can never prove that it worked, only that it failed. But I believe that the American nuclear deterrent—forged in part by those who we are honoring today— made global war unthinkable.

We can debate whether the long era of peace in Europe that nuclear weapons gave us was worth the horrible risk. We can argue about the future relevance of those weapons. But we should be conscious of the fact that many of us are alive to conduct those arguments as a direct result of the accomplishments of the scientist and engineers and technicians represented by the eleven extraordinary individuals before us today. And so both on behalf of those like me who know how much they owe and on behalf of those who have forgotten it, let me simply say thank you.

<u>Beyond the Cold War</u>

But now we are past the Cold War. You who gave birth to the U.S. nuclear deterrent have a right to ask us what we are doing with your legacy. Are nuclear weapons still

relevant to our security? The answer is "yes," although with a reduced emphasis, as the Administration's Nuclear Posture Review has made clear.

Nuclear forces are an insurance policy for an uncertain future. Who would have predicted even twenty years ago today's changed security posture? Who, today, is willing to claim to see the future well enough to say that nuclear weapons will not be relevant to our security twenty years hence?

This week is the anniversary of another event. Ten years ago—July 11, 1995—Serb forces perpetrated a massacre in Srebrenica. Thousands of Bosnian Muslim men—many non-combatants—were murdered in cold blood and their bodies thrown into huge pits and covered up in the night to hide this deed. Forty years after the defeat of Germany bought the end of the holocaust, genocide once again came to Europe. I do not argue that U.S. nuclear weapons were relevant to this particular case; they were not.

But we must recognize that evil still exists, and the coupling of evil with weapons of mass destruction is of terrifying concern. The United States must maintain a full set of military capabilities able to deter or counter any threat that emerges.

We have made remarkable progress over the past two decades in reducing nuclear threats. In 1995, when the Non-Proliferation Treaty was indefinitely extended, the United States reiterated its commitment under Article VI to work toward the long-range goal of eliminating nuclear weapons and to general and complete disarmament. The nuclear arms race has, in fact, been halted. While nuclear deterrence remains necessary, even after the Cold War, the United States has been reducing its nuclear forces and nuclear weapons stockpile in a consistent fashion through both unilateral and bilateral initiatives. Lets look at some recent accomplishments.

- **The Administration's 2001 Nuclear Posture Review, or "NPR", mandated reduced reliance on nuclear forces in achieving U.S. national security objectives in light of a growing ability to achieve these objectives with conventional capabilities and missile defenses.**
- **The 2001 NPR also articulated a vision, embodied in the Moscow Treaty, for additional deep reductions to a level of 1700-2200 operationally deployed strategic nuclear warheads by 2012, down from about 5300 as of the beginning of last year. These levels are far lower than many of us thought possible just a few years ago.**
- **Under the START Treaty and the Moscow Treaty, the United States will have decommissioned, over the period of two decades, more than three-quarters of the strategic nuclear warheads attributed to its delivery vehicles.**

- **In May 2004, President Bush decided on a major reduction in the total U.S. nuclear stockpile, including both operationally-deployed and non-deployed warheads. By 2012, the nuclear stockpile will be reduced by nearly one-half from the 2001 level, resulting in the smallest stockpile since the Eisenhower administration.**
- **The tactical weapons of the past—nuclear mines, anti-submarine weapons, nuclear artillery—are gone. The only nuclear weapons available for deployment today are those carried by our strategic triad of ICBMs, SLBMs, and heavy bombers, as well as a few non-strategic bombs and currently non-deployed nuclear-tipped sea-launched cruise missiles.**
- **The U.S. has no development programs underway for new or modified nuclear warheads. Indeed, we have not developed and fielded a new warhead for nearly 20 years. The last time we modified an existing warhead—**

the B-61-11 earth penetrator (to provide a safer way to achieve existing military capabilities)—was during the Clinton administration.

These accomplishments are helping to realize the President's vision of achieving the lowest possible number of nuclear weapons consistent with our need to deter current and future threats to the United States and its allies and friends. Moreover, this record, coupled with the great progress the U.S. has made in reducing nuclear threats in other areas, demonstrates strong U.S. adherence to its own nonproliferation commitments and U.S. leadership in support of other countries' nonproliferation interests and commitments.

But although the President directed major reductions in nuclear weapons, he did not endorse reductions to a few hundred warheads, as some may have preferred. The 2001 Nuclear Posture Review, which established the conceptual basis for thinking about nuclear weapons in the 21st century,

identified four roles for U.S. nuclear forces: assure friends and allies, dissuade competitors, deter aggression, and deny or defeat aggression should deterrence fail. The first two roles have important implications for force size. We must maintain sufficient forces to assure allies that we can do more than simply deter attacks on the U.S. homeland, but that we can also extend deterrence to them. Otherwise we will encourage them to proliferate. And we must retain a large enough force to dissuade any power from seeking a competitive advantage in nuclear forces.

Let me turn to our efforts to transform America's nuclear stockpile for the 21st century, and to create a responsive nuclear weapons infrastructure. I must first emphasize that stockpile stewardship is working, that we are confident that the U.S. stockpile is safe and reliable, and that there is no need at this time for nuclear tests. This assessment derives from ten years of experience with science-based stockpile stewardship, from extensive surveillance of our weapons,

from the use of both experiments and advanced simulation and computation, and from professional judgment.

Despite this success., there is more to be done. Although nuclear weapons issues are usually contentious, most would agree that if we were starting to build the stockpile from scratch today we would take a much different approach than we took during the Cold War. Today's Cold War legacy stockpile is the wrong stockpile from a number of perspectives. Let me explain.

First, today's stockpile is the wrong stockpile technically. Most current warheads were designed to maximize explosive yield with minimum size and weight so that many warheads could be carried on a single delivery vehicle. As a result, our weapons designers, in managing risk during a period when we used nuclear tests as part of the tool kit to maintain confidence, designed closer to the so-called "cliffs" or margins in performance. If we were designing the stockpile today under a test moratorium and in

a world where most delivery systems will carry many fewer warheads than the maximum capacity, we would manage technical risk differently, trading size and weight for increased performance margins, system longevity, and ease of manufacture.

Second, the legacy stockpile was not designed for longevity. During the Cold War we introduced new weapons into the stockpile routinely and used our enormous production capacity to turn over most of the stockpile every 15-20 years. Today, our aging nuclear weapons are being rebuilt in life extension programs that are both difficult and costly. Rebuilding nuclear weapons will never be cheap, but decisions taken during the Cold War forced the use of certain hazardous materials that, in today's health and safety culture, cause warheads to be much more costly to remanufacture. Maintaining the capability to produce these materials causes the supporting infrastructure to be larger and more complex than it might otherwise be.

As a result of these decisions, it is becoming more difficult and costly to certify warhead remanufacture. The evolution away from tested designs resulting from the inevitable accumulations of small changes over the extended lifetimes of these systems means that we can count on increasing uncertainty in the long-term certification of warheads in the stockpile. To address this problem, we must evolve our strategy from today's "certify what we build" to tomorrow's "build what we can certify."

We are exploring whether there is a better way to sustain existing military capabilities in our stockpile absent nuclear testing. With the support of Congress, we are beginning a program—the Reliable Replacement Warhead (RRW) program—to understand whether, if we relaxed Cold War warhead design constraints that drove tight performance margins in nuclear design, we could provide replacements for existing stockpile weapons that could be more easily manufactured with more readily available and

more environmentally benign materials, and whose safety and reliability could be assured with highest confidence, without nuclear testing, for as long as the United States requires nuclear forces. Such modified warheads would be designed specifically to facilitate less costly remanufacture and for ease of certification of safety and reliability. Thus they would reduce infrastructure costs needed to support the stockpile. Because they would be less sensitive to incremental aging effects, RRWs would dramatically reduce the possibility that the United States would ever be faced with a need to conduct a nuclear test in order to diagnose or correct a reliability problem. To establish the feasibility of the RRW concept, we will use the funds provided by Congress last year and those requested this year to begin studies on replacing warhead components while retaining the same military capabilities as existing warheads. If those studies suggest the RRW concept is technically feasible, and if the Department of Defense establishes a formal

requirement, we expect that by 2012 or 2015we can demonstrate that a Reliable Replacement Warhead can be manufactured and certified without nuclear testing.

If we are successful in this effort it will enable a fundamental transformation to a truly responsive infrastructure. Such an infrastructure will almost certainly allow even greater reductions in the total stockpile. Simpler, safer warheads that don't use exotic and dangerous materials will let us perform modifications in response to technical problems quickly and thus obviate the need to retain excess warheads as a hedge against technical failure. Once we establish a responsive capability to produce warheads on the timescale in which geopolitical threats could emerge, we will no longer need to retain excess warheads as a geopolitical hedge. Thus a responsive infrastructure will allow us to take another step in realizing the President's vision of the smallest stockpile consistent with our nation's security.

Our vision for transformation of the U.S. stockpile and nuclear infrastructure is fully consistent with the Administration's strong support for nonproliferation. Transformation will enable us to achieve a smaller stockpile, one that is safer and more secure, one that offers a reduced likelihood that we will ever need to test again, and one that enables a much greater ability to respond to changes. Most importantly, this effort will ensure a credible deterrent for the 21st century, thereby reducing the likelihood we will ever have to employ our nuclear capabilities in defense of the nation and its allies.

At the Trinity site, now part of the White Sands Missile Range in New Mexico, there is a marker with a simple inscription: "Where the world's first nuclear device was exploded on July 16, 1945." We must never forget the men and women who helped bring the Second World War to a close and helped win the Cold War. All Americans can be proud of this legacy—we are forever in your debt. On behalf

of the Department of Energy, of the Administration, of the nation and of generations unborn who are safer because of your service, I salute you. We will continue to ensure that your legacy is used responsibly to protect America's security. Thank you.